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DECEMBER 1946

UNITED STATES
DEPARTMENT OF THE INTERIOR
J. A. KRUG, SECRETARY

BUREAU OF MINES
R. R. SAYERS, DIRECTOR

INFORMATION CIRCULAR

DESCRIPTION OF THE EICKHOFF-SCHRÄMLADER LONGWALL COAL-CUTTING AND LOADING MACHINE

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DESCRIPTION OF THE EICKHOFF-SCHRÄMLADER LONGWALL COAL-CUTTING AND LOADING MACHINE[1/]

By Einar M. Arentzén[2/]

CONTENTS

	Page
Introduction	2
Acknowledgments	2
Description of machine	2
Instructions for crew operating machine	3
Cutting crew	3
Machine operator	3
Helper at gathering conveyor	4
Instructions to be followed at end of shift	4
Method of placing machine in new working place	4
Important points to consider before machine is installed	4
General discussion	4
Conclusions	5

ILLUSTRATIONS

Fig.		Following page
1.	Side of the Eickhoff-Schrämlader cutting and loading machine	2
2.	Sections showing the necessary tilting of the Eickhoff-Schrämlader cutting and loading machine	2
3.	Eickhoff-Schrämlader cutting and loading machine showing arrangement of gathering conveyor loading directly into shaker conveyor	2
4.	Eickhoff-Schrämlader cutting and loading machine using the extra elevating conveyor and cross conveyor for loading into shaker conveyor	2
5.	Top and side of Eickhoff-Schrämlader cutting and loading machine with elevating and cross conveyors	4
6.	Coal face after cutting and loading has been completed	4
7.	Machine in operation showing cut made by disk at end of raking bar	4

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INTRODUCTION

This information circular deals primarily with an engineering description of a type of longwall cutting and loading machine developed by Eickhoff Maschinenfabrik, Bochum, Germany.

This machine is supposed to have been developed and tested during the latter part of 1941 and early 1942. The only source of information is contained in certain literature and engineering data, with drawings which were acquired by the Allied Military Authorities when Germany was occupied; and the information will have to be limited because the writer has not seen the machine in the factory or in operation. However, the information may be of interest to the coal-mining industry in this country, and for this reason our Government has decided to publish the data procured so far.

The Eickhoff cutting and loading machine is particularly suitable for the longwall mining system. It can only be used under that type of mining system and is not suitable for the more common type known in this country as room-and-pillar work.

The material for the description of the machine and its operation was compiled and translated from German drawings and operating instructions. These detailed drawings and instructions are on file with the Bureau of Mines and are available for inspection by any responsible person interested in the details of the construction of the machine.

ACKNOWLEDGMENTS

The interest of Robert P. Koenig, president of Ayrshire Collieries Corp., formerly colonel and chief, Solid Fuels Section, Supreme Headquarters, A.E.F., in securing drawings and descriptive matter regarding the Eickhoff-Schrämlader and forwarding this information to the Bureau of Mines, is appreciated.

DESCRIPTION OF MACHINE

In figure 1, it should be noticed that the basis of the machine is a typical longwall jack-knife-type coal-cutting machine for cutting a bottom kerf approximately 5 feet deep by a chain-cutter bar. An auxiliary cutting unit consisting of a round raking bar mounted in a substantial supporting arm is mounted on top of this cutting machine. The arm is hinged on the mounting base and can be lifted up and down by hydraulic jacks so as to place the raking bar in any position between the chain cutter bar and the roof. This bar rakes down the coal at the face as it is being undercut in advance. At the end of this raking bar is fitted a cutting disk approximately 2 feet in diameter, which will cut a notch in the coal seam close to the rib and thereby help to dislodge the coal more readily. The raking bar can also be operated in the manner shown in figure 2, section E-F, cutting underneath the coal and up toward the roof.

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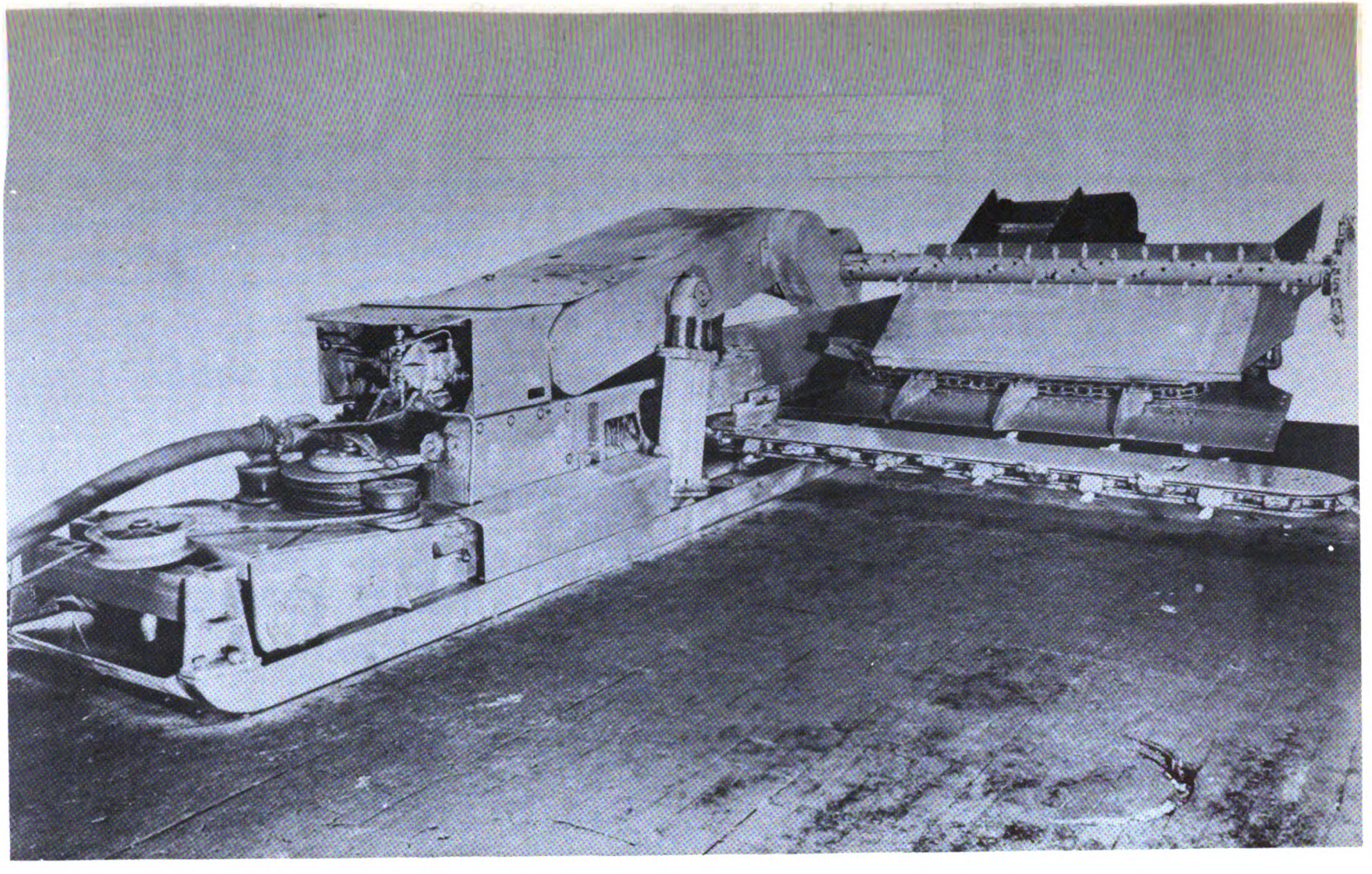

Figure 1. - Side of the Eickhoff-Schrämlader cutting and loading machine.

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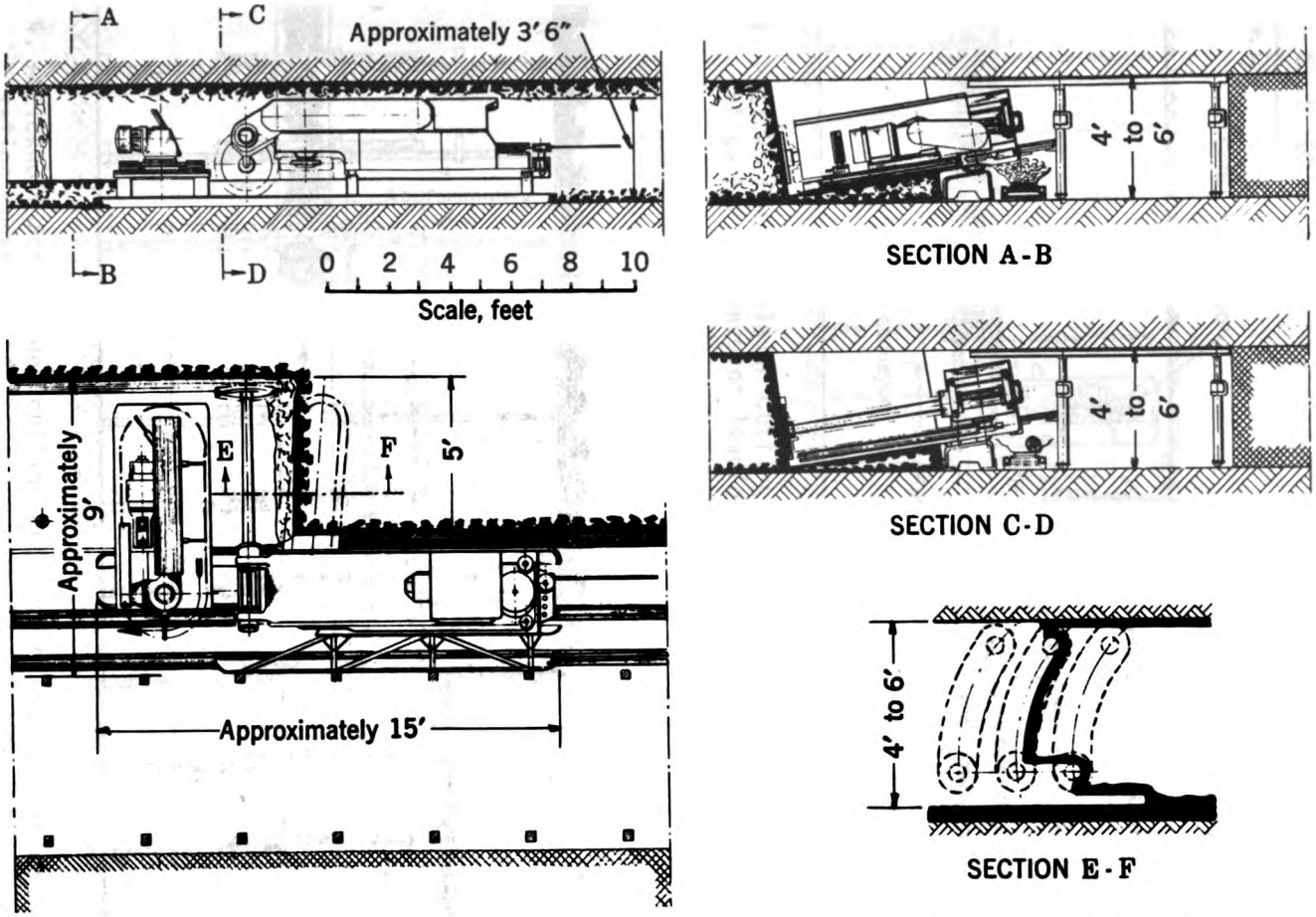

Figure 2. - Sections showing the necessary tilting of the Eickhoff-Schrämlader cutting and loading machine.

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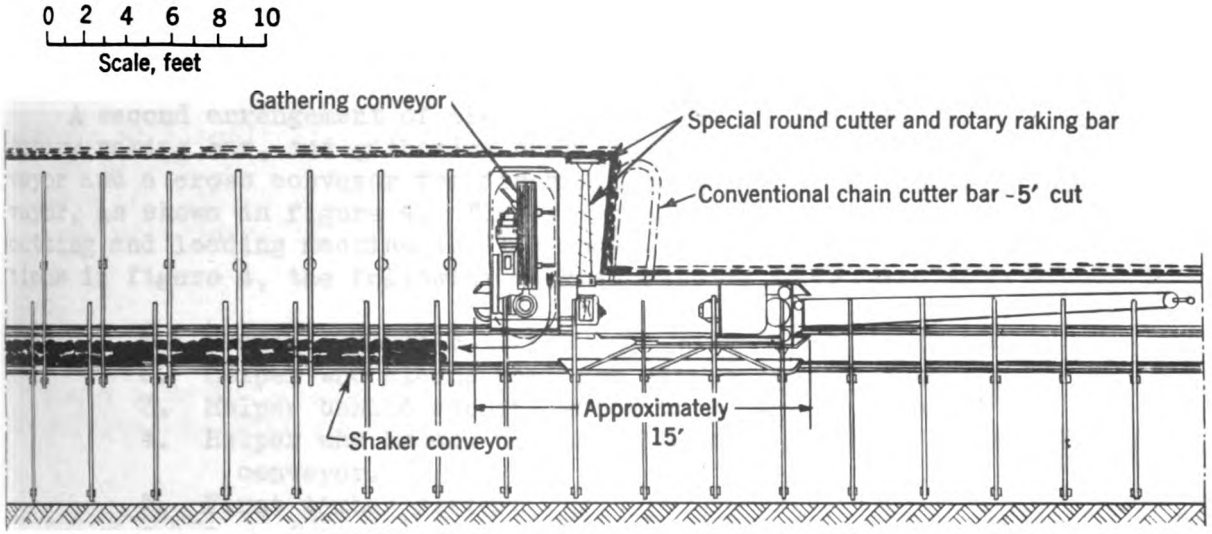

Figure 3. - Eickhoff-Schrämlader cutting and loading machine showing arrangement of gathering conveyor loading directly into shaker conveyor.

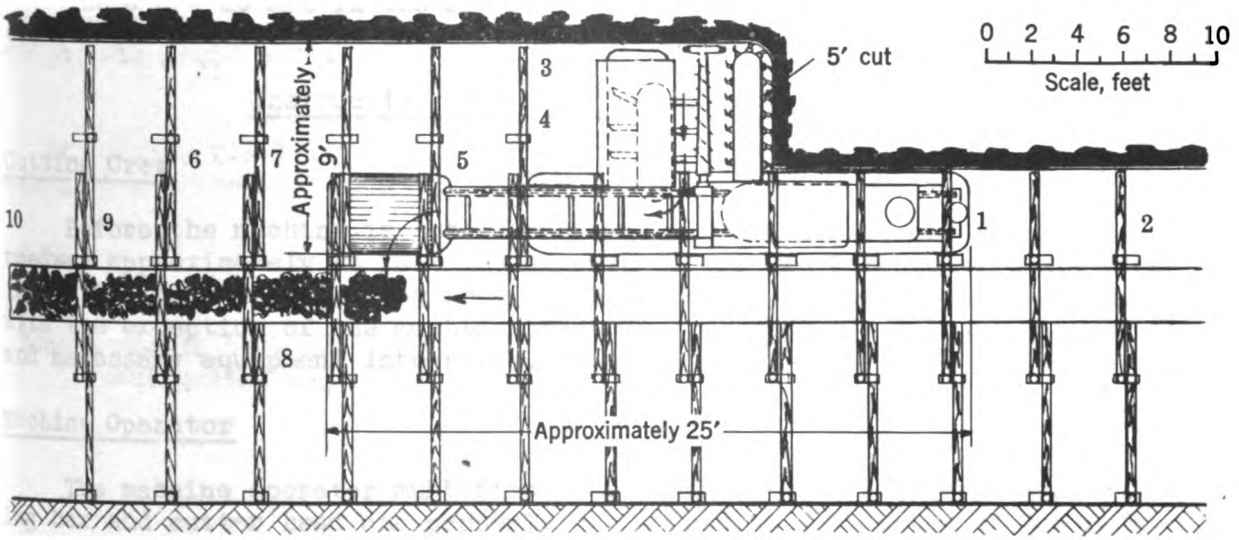

Figure 4. - Eickhoff-Schrämlader cutting and loading machine using the extra elevating conveyor and cross conveyor for loading into shaker conveyor.

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A horizontal "gathering conveyor," consisting of the regualr chain-and-flight-type conveyor, follows the chain cutter bar and the rotary raking bar. The edge of this conveyor rests on the mine floor, and the flights contact the loose coal that has been brought down by the raking bar and deliver this coal onto a longwall shaker conveyor, as shown in figure 3.

A second arrangement of the machine embodies the same cutting machine, rotary raking bar, and gathering conveyor and also uses an elevating conveyor and a cross conveyor for discharging the coal onto the longwall conveyor, as shown in figure 4. The arrangement of the working crew for the cutting and loading machine is also shown. Referring to the marked positions in figure 4, the following workmen will be identified as:

1. Machine operator.
2. Helper who cleans path for machine and set rope jack.
3. Helper behind machine watching gathering conveyor.
4. Helper who breaks up large lumps of coal on elevating conveyor.
5. First timber setter.
6. Second timber setter.) In spare time clean
7. Third timber setter.) up coal spillage.
8. Man who watches shaker conveyor and sets timber on opposite side of shaker.

9. and 10. Clean-up men.

There are 10 men in the crew, and it should be noted that workmen 2 and 10 can be eliminated under certain circumstances.

Instructions for Crew Operating Machine

Cutting Crew

Before the machine is set in operation, four or five men clear the roadway approximately 66 feet ahead. Two of the men proceed with the placing of the jack for the drag rope of the machine, and the remaining men, with the exception of the machine operator, proceed with getting mine props and necessary equipment into place.

Machine Operator

The machine operator must first determine if the head supporting raking bar and cutter head can properly be lowered to the bottom of the main body of the machine. Next, he must make certain that the air power line is clear or, in case of electric power, the cable properly connected and that the main switch is turned on. The operator must thoroughly inspect the machine to make certain that it is properly lubricated, and before operating the machine, he must start the motor to make sure the oil pump is delivering pressure.

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Helper at Gathering Conveyor

The helper at the gathering conveyor is responsible for turning the headlight on that conveyor, and must inspect the lubrication of that part of the machine. This same helper should also see that the gathering conveyor chain is properly adjusted and maintained in proper working condition.

Instructions to be Followed at End of Shift

The mechanic examines the machine thoroughly and lubricates it according to instructions. He inspects the entire machine for any defects so that it will be ready and in good condition for the next shift. He also examines the tightness of the chains and changes the cutter bits on the cutting head and raking bar.

Method of Placing Machine in New Working Place

The machine is placed in a new working place by means of pull ropes and a hoisting mechanism, and this same procedure and method are applied to get the machine in operation.

The cutting loader is a machine where good teamwork is required between the operator and the rest of the crew to obtain maximum efficiency.

Important Points to Consider before Machine is Installed

1. The ventilation must be in proper order because of the great amount of fine cuttings and dust created by the machine.

2. It is considered that steel jacks, adjustable type, are preferable able to plain wood timbers.

3. The system of mining would have to be carefully planned to give the machine continuous operation without having to be moved a long distance for re-set-up.

GENERAL DISCUSSION

The machine is reported to have been installed and used in the Jacobi coal mine in Germany and produced the following tonnages during 1942:

1942	Tons
August.....	10,433
September....	10,750
October.....	12,267

No definite information is available as to man-hours required to operate this machine, including all necessary deadwork in connection with getting the machine started and placed in operation and moving the machine from one longwall to another prepared working face; but it is evident that considerable time is required to set up this machine as compared to the time it would take to finish cutting and loading out one longwall face.

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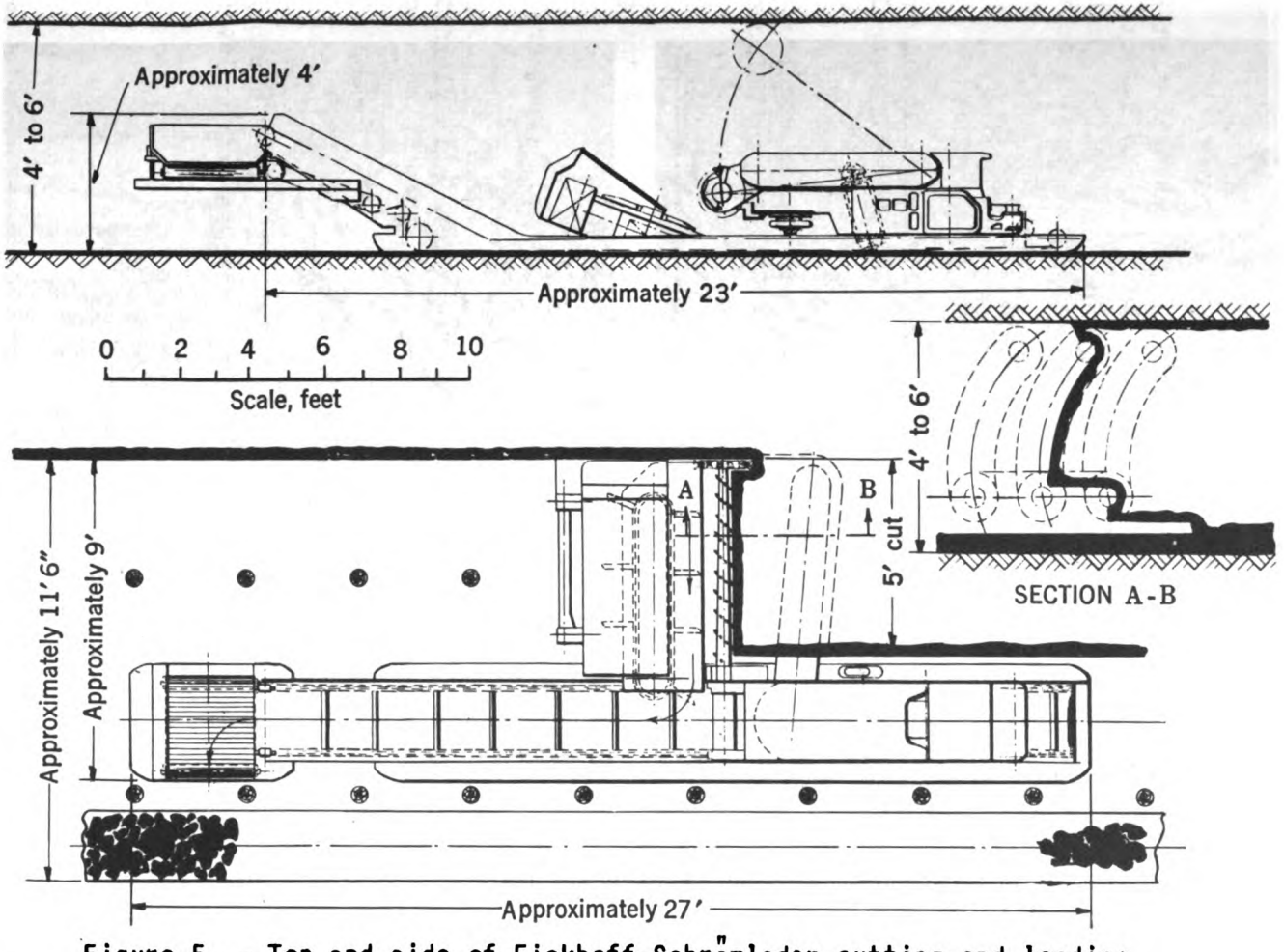

Figure 5. - Top and side of Eickhoff-Schrämlader cutting and loading machine with elevating and cross conveyors.

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Figure 6. - Coal face after cutting and loading has been completed.

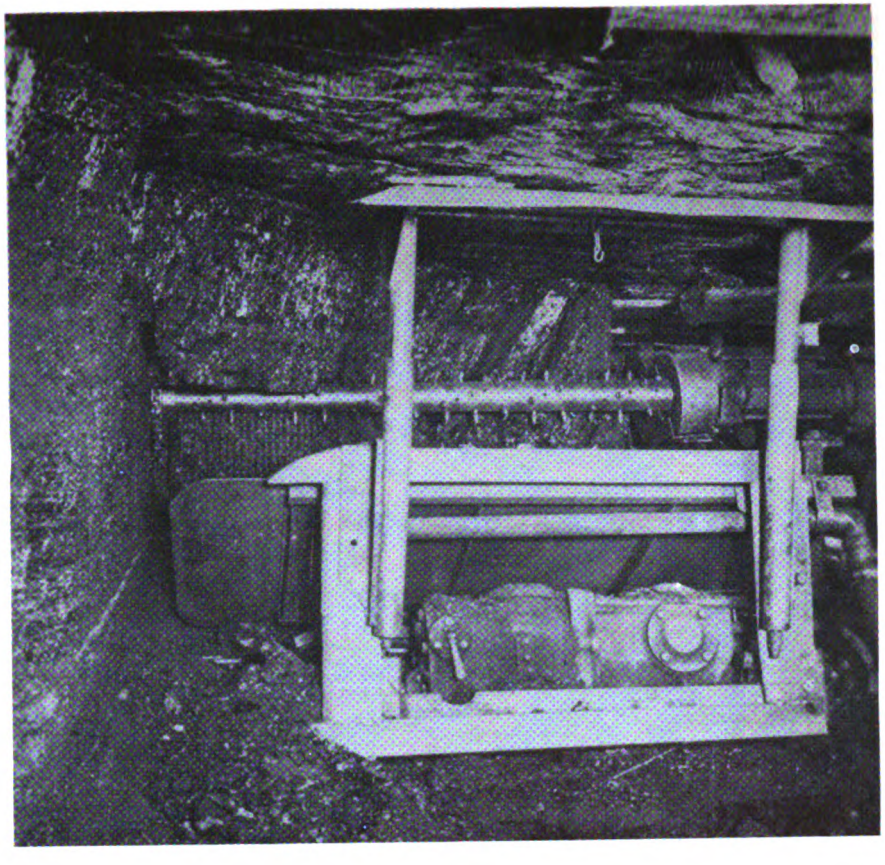

Figure 7. - Machine in operation showing cut made by disk at end of raking bar.

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The detailed drawings of the machine disclose a well-designed and well-built piece of machinery. It does not incorporate any questionable mechanical features and should be very simple to maintain and operate.

The speed and capacity of the machine will vary greatly with the character of the coal seam to be mined. The speed of undercutting is well known to the mining industry, but on this machine the speed of advancing along the face must necessarily be much slower than the speed of the cutting machine because the rotary raking bar will have to travel up and down the open end cut to dislodge the coal. The writer believes that the rope speed of this cutting and loading machine is approximately one-half normal speed of undercutting operation.

It should be noted that in figure 2, sections A-B, C-D, the machine, as well as the gathering conveyor, has to be slightly tilted to enable the gathering conveyor to carry the coal from the floor over the edge and into the shaker conveyor. This tilting of the machine involves extra work because it leaves a wedge of coal that must be removed by hand-picking and shoveling.

In figure 5, where the machine is illustrated with the extra elevating and cross conveyors, this same obstacle, as pointed out in figure 2, is also involved, and therefore the machine is very much handicapped by the fact that the gathering conveyor is not designed to sweep perfectly level to the floor. Such modification would be quite an improvement to the machine and would enable the machine to work level with the floor.

It should be noted that the cutting disk at the end of the raking bar cuts the coal approximately 6 inches higher than the reach of the raking bar. (See figs. 6 and 7.) Apparently, the intention is that any of the coal that sticks to the roof will have to be picked down by hand.

CONCLUSIONS

This type of machine could easily be manufactured in the United States if the coal-mining industry desires to experiment along this line, particularly on longwall work. However, the writer believes that a combination of the cutting elements of this machine with some type of well-known mechanical loader already used in this country, such as a light-crawler-type loader, would make a better combination and be more flexible than the arrangement of conveyors shown with the machine described.

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